Citation:

Bogaert N, Steinbeck KS, Baur LA, Brock K, Bermingham MA. Food, activity and family--environmental vs biochemical predictors of weight gain in children. *Eur J Clin Nutr*. 2003 Oct;57(10):1242-9.

PubMed ID: 14506484

Study Design:

Cohort design (prospective)

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

1. To identify, prospectively, whether simply measured indicator of energy intake and expenditure might predict excessive weight gain over time in a cohort of prepubescent children, who had been well described in biochemical and metabolic terms, and in whom we have identified some biochemical predictors of weight gain.
2. To add further information about the relation between weight gain and biochemical predictors in prepubescent children.
3. To describe how these simple measures of energy intake and expenditure in children might relate to similar measures in parents.

Inclusion Criteria:

Prepubertal children ages 6 to 9 years with at least one biological parent agreeing to participate and follow-up after 12 months.

Exclusion Criteria:

Not stated

Description of Study Protocol:

Recruitment

Through advertisement in a university teaching hospital and in nongovernmental schools in the local area.

Design

Initial assessment as taken after an overnight fast. Data collected: body weight and height, body composition (bioelectrical impedance analysis) and body fat (skinfold test), indirect calorimetry, 3

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day food record, physical activity record, step test (physiological effect of recorded physical activity), lifestyle indicators of physical activity and inactivity, lipid profile.

Statistical Analysis

Unpaired t-tests (identified gender differences and high vs. low scores by median split and compared by mean difference), analysis of covariance (comparison of groups involving lean body mass adjustment), correlations (relation between variables & partial correlations to adjust for confounding variables), Pearson's product moment correlation (relation between variables with a normal distribution), Spearman's rank order correlation (relation of non-normally distributed data).

Data Collection Summary:

Timing of Measurements

At baseline, 6 and 12 months, the child's weight and height were measured.

Dependent Variables

- Body mass index
- Body composition (bioelectrical impedance analysis)
- Body fat (skinfold test)

Independent Variables

Energy intake, % nutrient intake (protein, fat, carbohydrate, saturated fat, monounsaturated fat, polyunsaturated fat), physical activity, hours of television viewing

Control Variables

History of breastfeeding, meal pattern, food consumed away from home, parental macronutrient intake (including fatty acids), childrens' lipid subfractions (lipid levels were taken by serum collection; a turbitimer measured apoprotein).

Description of Actual Data Sample:

Initial N: 43 families (59 prepubertal children, 41 mothers and 29 fathers)

Attrition (final N): 41 children (reviewed at 12 months), 21 boys, 20 girls

Age: 6 to 9 years

Ethnicity: Not stated

Anthropometrics:

- BMI z-scores: boys (0.3±0.1), girls (0.5±0.3).
- Percentage body fat: boys (18.4±1.2), girls (25.8±1.1).
- Percentage lean body mass: boys (81.6±1.2), girls (74.2±1.1)

Location: Australia

Summary of Results:

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Girls had a significantly lower mean body mass ($p<0.0001$) and significantly greater mean fat mass than boys ($p<0.0001$). In children, a significant positive correlation was found between percent body fat when measured by BIA or calculated from skinfolds.

Boys had a significantly higher adjusted resting metabolic rate than girls, with values of 5.4±0.15 MJ/24h and 4.7±0.15 MJ/24h, respectively ($p=0.02$).

Dietary Factors

The average daily intake for mothers and fathers was 17 and 24% lower, respectively, than that of the National Nutrition Survey, and the macronutrient distribution, including fatty acid subtype distribution was similar to that of their children.

Under-reporting was identified in 21.5% of children. Under-reporting in boys was global for the three macronutrient groups, whereas in girls under-reporting was significantly greater for protein and carbohydrate. For parents, the under-reporting figures were 52 and 45% for mothers and fathers, respectively. The girls classified as under-reporters were significantly heavier at baseline BMI z-score and had a higher percentage body fat than girls who were not under-reporters, 2.4±2.24 versus 0.15±1.1 ($p=0.01$), 31.7±6.9 versus 24.1±4.4% ($p=0.004$).7

Percent body fat was measured & correlated positively with BMI z-score, but only the BMI z-score was examined in relation to dietary fat. Investigators were unable to demonstrate a positive relation between dietary fat and BMI z-score change from baseline to 12 months. There were no other significant correlations identified between BMI z-score change and any measured dietary variable.

Physical Activity Factors

The percent time spent in low-intensity activity correlated significantly with the percent body fat for all children ($r=0.28$, $p=0.04$), but when genders were considered separately, only girls had a trend towards a significant relationship ($r=0.4$, $p=0.06$).

Boys had a significantly lower mean pulse rate at resting ($p=0.02$) and at poststepping intervals.

For the entire cohort of children, no significant correlation was found between BMI z-score change and baseline adjusted RMR, fasting RQ, hours of planned exercise, hours of television viewing and either percent time in low-intensity activity, percent time in moderate intensity activity and percent time in moderate to high intensity activity. In addition, no differences were found between those with a change in BMI z-score from baseline to 12 months =median compared to those with a change in BMI z-score baseline to 12 months >median for any of the variables of interested.

The BMI z-score change over 12 months was significantly correlated with LDL cholesterol and Apo B/Apo A-1 ratio and both these relationships were independent of percent body fat (both a calculated lipid subfraction, LDL cholesterol, and an independent measurement of the apoprotein components of the lipoproteins, the apoprotein B/A 1 ratio, are predictive of weight gain).

A significant positive correlation was found for mothers and girls for percent time in moderate to high activity (r-0.44, $p=0.03$). Between fathers and the cohort of children, a strong significant positive correlation was found for percent time spent in low activity (r-0.43, $p=0.005$).

Author Conclusion:

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This study has extended the evidence on biomechanical predictors, which identify propensity to faster weight gain over time in children – biomechanical predictors that are lifestyle influenced. The study has, however, been unable to identify environmental predictors of the same. The important environmental findings are the overall lack of vigorous activity in this age group, and the correlations between parental and child activity in an Australian population.

Reviewer Comments:

Strengths:

Cohort characteristics similar to larger Australian cohorts.

Limitations:

- *Relatively small cohort.*
- *Under-reporting by heavier and fatter girls*
- *Frequency, duration, type and intensity of physical activity are not easy to document precisely. Over- and under-reporting of physical activity are possible.*

Other Comments

Mean television viewing hours were considerably less than those reported in the American literature (Gortmaker et al, 1996).

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes

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1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	Yes
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	Yes

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5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes

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	7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes

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